

PROBOPYRUS PACIFICENSIS, A NEW PARASITE SPECIES
(ISOPODA: BOPYRIDAE) OF
MACROBRACHIUM TENELLUM (SMITH, 1871)
(DECAPODA: PALAEMONIDAE) OF THE
PACIFIC COAST OF MEXICO

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Abstract.—*Probopyrus pacificensis*, a new species of Bopyridae parasitizing the freshwater prawn *Macrobrachium tenellum* (Smith, 1871) is described from the Pacific coast of Mexico. This is the first species of *Probopyrus* described from the Eastern Pacific although *P. pandalicola* (Packard, 1879) has been reported earlier from this slope of the Americas. *P. pandalicola*, *P. palaemoneticola* (Packard, 1881), and *P. floridensis* Richardson, 1904 are differentiated from *P. pacificensis* because they are smaller, by their dorsal pigmentation, morphological features and because they parasitize *Palaemonetes* spp. *P. bithynis* Richardson, 1904 exhibits anterolateral projections in its head resembling horns; this feature makes it different from other species in the genus. *P. pacificensis* is distinguished from *P. panamensis* Richardson, 1912 by its laminar and separated edges in the pereomeres 5–7 on the larger side, and a high and rounded carina on the seventh leg; *P. panamensis* has continuous pereomeres and a lower carina. The final hosts of *P. bithynis* are *M. ohione* (Smith, 1874) and *M. olfersi* (Wiegmann, 1836), while *M. acanthurus* (Wiegmann, 1836) and *M. tenellum* are parasitized by *P. panamensis* and *P. pacificensis*, respectively.

The genus *Probopyrus* Giard & Bonnier (1888) comprises a complex of species distributed along southeast Asia and the Americas. It has been a controversial genus because of the difficulty of separating the species of the group on the adult morphology.

Giard & Bonnier (1888) proposed the bopyrid genus *Probopyrus* to accommodate some western Pacific species. The following species have been described from the western Atlantic: *P. pandalicola*, *P. palaemoneticola*, *P. bithynis*, *P. floridensis*, and *P. panamensis*.

In 1905, Richardson proposed a key to identify the American species of the genus *Probopyrus*, but Markham (1985a) stated that the key was not suitable because of the

difficulty distinguishing the adults on the basis of morphological features.

Probopyrus pandalicola, *P. floridensis*, and *P. bithynis* have been recognized as valid species by Dale & Anderson (1982) based on observations of behavior, pigmentation patterns, and larval morphology; these species have been accepted by Jimenez & Vargas (1990).

Markham (1985a) pointed out that most of the other species of *Probopyrus* in the western Atlantic are synonyms of *P. pandalicola* and that it is “the only known branchial parasite of *Macrobrachium*, *Palaemon*, and *Palaemonetes* in the northwestern Atlantic, where it infests at least ten different host species.”

Despite the presence of potential hosts in

the western slope of the Americas (Holthuis 1952, Wicksten 1989, Villalobos-Hiriart & Nates-Rodriguez 1990, Wicksten & Hendrickx 1992, Markham 1992), no species of *Probopyrus* have been described to date from the eastern Pacific, although *P. pandalicola* has been reported earlier from the Pacific drainage of the Americas by Markham (1974, 1985a, 1992), Campos & Campos (1989), Salazar-Vallejo & Leija-Tristan (1989), and Jimenez & Vargas (1990).

From a study on the biology and ecology of *M. tenellum*, one of the most common prawns found in fresh and brackish water in the coastal area of the Mexican eastern Pacific, a large number of specimens were infested with a branchial parasite that was reported as *Probopyrus* sp. by Román (1979, 1983), and as *P. pandalicola* by Guzmán & Román (1983), and Román (1991).

The morphological analysis of approximately 2500 specimens of this parasite collected between 1975 and 1992 in Guerrero and Michoacan States, Pacific coast of Mexico, and of specimens examined in the Instituto de Biología, Universidad Nacional Autónoma de México (UNAM), and compared with holotypes and paratypes at the USNM Smithsonian Institution, lead me to the conclusion that the branchial parasite found on *M. tenellum* belonged to an undescribed species of *Probopyrus*.

The terminology and morphological characters used in the text are those proposed by Markham (1985a, 1985b, 1988). Figures 2B–I, and 2K–M were made with the aid of a photograph taken with scanning electron microscopy (SEM); two fully developed individuals, male and female, were used for descriptions and chosen as type specimens.

Probopyrus pacificensis, new species

Figs. 1, 2

Bopyrids, Holthuis, 1954:6, 7 (Rio Zunzal, and Rio Conchalió, El Salvador, C.A.); infesting *M. tenellum*.

Probopyrus sp.—Román, 1979:157; 1983:361; infesting *M. tenellum*.

Probopyrus pandalicola.—Guzmán & Román, 1983:345–357 (not *P. pandalicola*); infesting *M. tenellum*.—Román, 1991:109–119 (not *P. pandalicola*); infesting *M. tenellum*.

Holotype female.—USNM 259483, *allotype male*: USNM 259484.

Paratypes.—USNM, Smithsonian Institution: 184037, 235984, and 241946; San Diego Natural History Museum; Instituto Nacional da Pesquisas da Amazonia, Brazil (INPA); Rijksmuseum van Natuurlijke Historie, The Netherlands (RMNHL); Muséum national d'Histoire Naturelle, Paris (FMNHN); Instituto de Biología (IB-UNAM), and Instituto de Ciencias del Mar y Limnología (ICMyL-UNAM), Mexico.

Type locality.—Tres Palos Lagoon, Guerrero, México (16°43' to 16°49'N, and 99°39' to 99°46'W).

Host.—The species has been collected only from *Macrobrachium tenellum*.

Material examined.—Holotype of *P. bithynis* (USNM: 29089), holotype of *P. floridensis* (USNM: 29090), holotype of *P. panamensis* (USNM: 43503), and paratypes of *P. pandalicola* (USNM: 172345, and 181548); ICMYL-UNAM: 2500 females, 825 males, 11 cryptoniscus, and 1 epicaridium, collected between 1975 and 1992; Pacific coasts of Guerrero and Michoacan States, México.

Range and habitat.—Eastern Pacific from México to El Salvador, C.A.; the southern part of the range is taken from a report by Holthuis (1954). Found in freshwater lagoons and associated rivers and ponds, always as a branchial parasite of *M. tenellum*.

Diagnosis.—Female (Fig. 1). Maximum length 13.5 mm, maximum width 11.0 mm. Distortion either dextral or sinistral, up to 30°. Outline subovate. Anterolateral corners of head slightly acute. Two pairs of subtriangular antennae, first one with three articles; second one bigger and with two articles. Maxilliped with acute plectron, palp

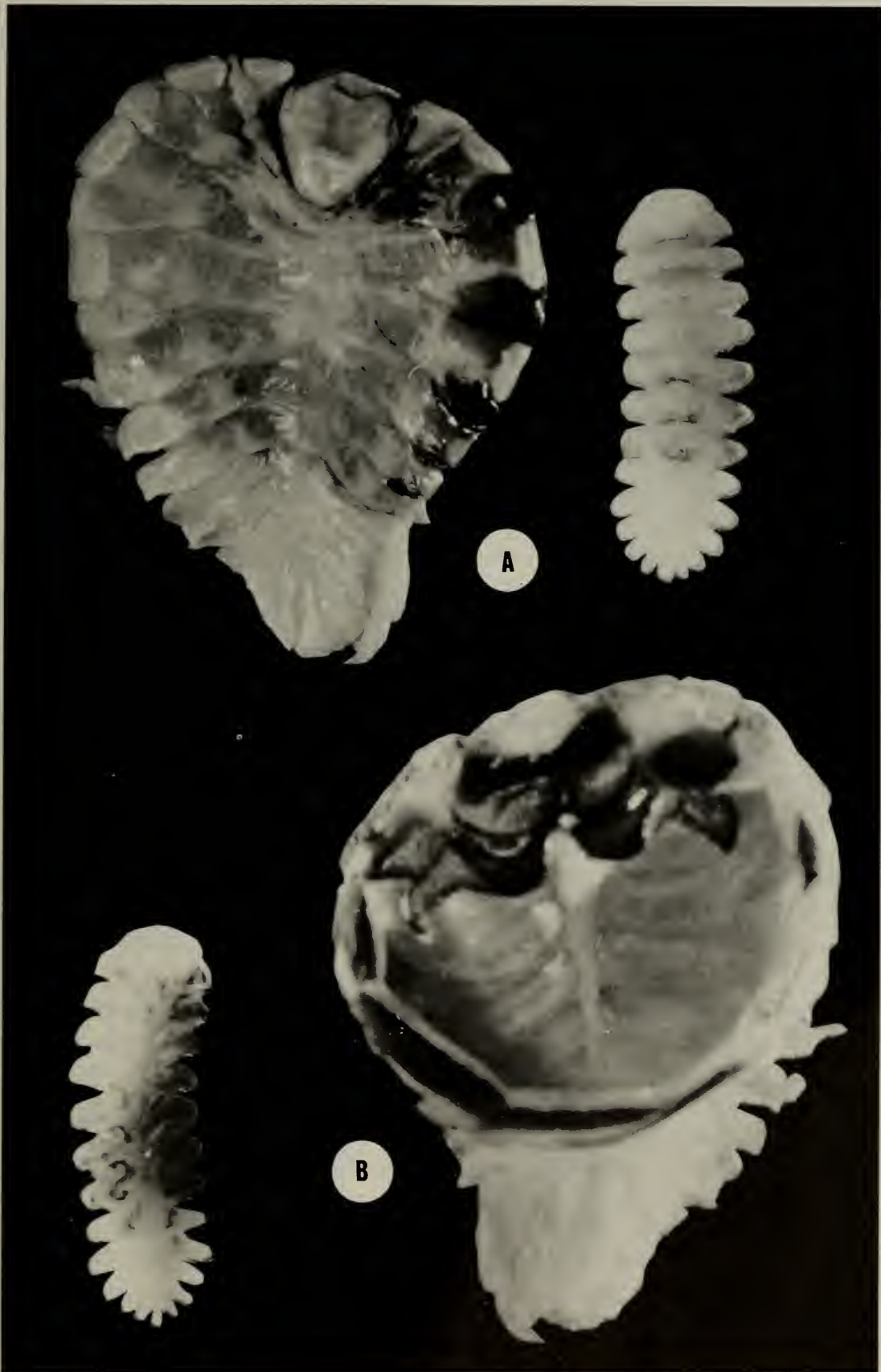


Fig. 1. *Probopyrus pacificensis*, new species. A, Holotype female (left) and allotype male (right), dorsal view. B, Allotype male (left), holotype female (right), ventral view.

of maxilliped unsegmented with 8 to 10 setae. Oostegite 1 relatively large, anterior margin concave, falcate and rounded; posterolateral tip triangular in shape and perpendicular to the former; internal ridge with digitate processes. Pereopods with a high and rounded carina. Dark brown or black pigmentation present dorsally on tergal projections of pereomeres 2–4 on short side; all oostegites with pigmentation. Small transverse patches of pigment present on pereomeres 5–7. Pleopods protruding beyond border on short side.

Description of female (Fig. 2A–I).—Head longer than wide, broadly cuneate, deeply set into first pereomere; anterolateral corners usually produced into inconspicuous acute or rounded tip, lacking frontal lamina. First antennae with 3 articles and tuft of terminal setae (Fig. 2B), second antennae flat, bigger than first, with 2 articles; distal article with rounded tip and terminal setae (Fig. 2C). Maxilliped almost rectangular in outline, distally segmented (Fig. 2D); short nonarticulated setose ovoid palp on margin of anteromedial corner with 8 setae (Fig. 2E); slender plectron with rounded tip extending anteriorly (Fig. 2F); exterior border of maxilliped with a notch; posterior border nearly perpendicular to medial edge, its medial corner approximately in same line. Barbula with 2 lateral projections on each side; inner small and slender, outer broad and blunt; middle region produced into one acute and elevated ridge (Fig. 2G). Eyes absent.

Margin of pereon forming a smooth curve; pereomeres 5–7 laminar and rounded, separated by deep notches on long side; anterolateral corners of pereomeres 1–4 produced into distinct dorsolateral bosses, coxal plates narrow. Oostegites completely surrounding but not enclosing brood pouch; oostegite 1 relatively large covering most of anterior part of brood pouch; anterior margins slightly concave, falcate and rounded (Fig. 2H); anterior segment approximately $\frac{1}{2}$ of total length; posterolateral tip subtriangular in shape and more or less perpendic-

ular to the former; internal ridge bearing many digitate ovoid processes. Small setae sometimes present on borders of inner ridge. Pigment, if present, in reticular pattern except on margins, or with small patches of black or brown pigment. Oostegites 2–4 suboval, a little smaller than oostegite 1; fifth oostegite long and slender, falcate in outline, ending in blunt to sharp tip, densely setose along posterior margin, extending entirely across posterior region of brood pouch and overlapping opposite number. Pereopods with all articles distinct, increasing slightly in length posteriorly; basis of all pereopods large, with round-shaped prominent carina, dactyli deeply set into propodi (Fig. 2I).

Pleon about 1–1.5 as long as wide; pleomeres separated laterally, margins perfectly differentiated; last pleomere bell-shaped, slightly notched posteriorly. Five pairs of biramous foliate pleopods almost completely covering ventral surface of pleon and protruding on short side (Figs. 1, 2A); in each pleopod, endopod somewhat larger and overlapping exopod, both rami progressively smaller from first to fifth pleopods. Uropods absent.

Description of male (Fig. 2J–M).—Length 2.6 mm, width 1.0 mm. All segments of pereon similar in length; all regions of body distinct. Head slightly trapezoidal, rounded anteriorly, wider than long, extended and deeply inserted into first pereomere; anterolateral borders rounded or slightly acute (Fig. 2J). Small, conspicuous eyespots; irregular pigmentation on pereomeres and pereopods. First antenna with globose proximal segment, short second article, and distally setose third article (Fig. 2L); second antenna with short proximal segment and long terminal segment ending in inconspicuous tuft of setae (Fig. 2K). Both antennae with scattered scales. Pereomeres 2–7 approximately of same length, tips rounded and slightly reflexed ventrally; pereopods rather small, slightly larger posteriorly, not carinate. Pleon unpigmented; 5 pairs of dis-

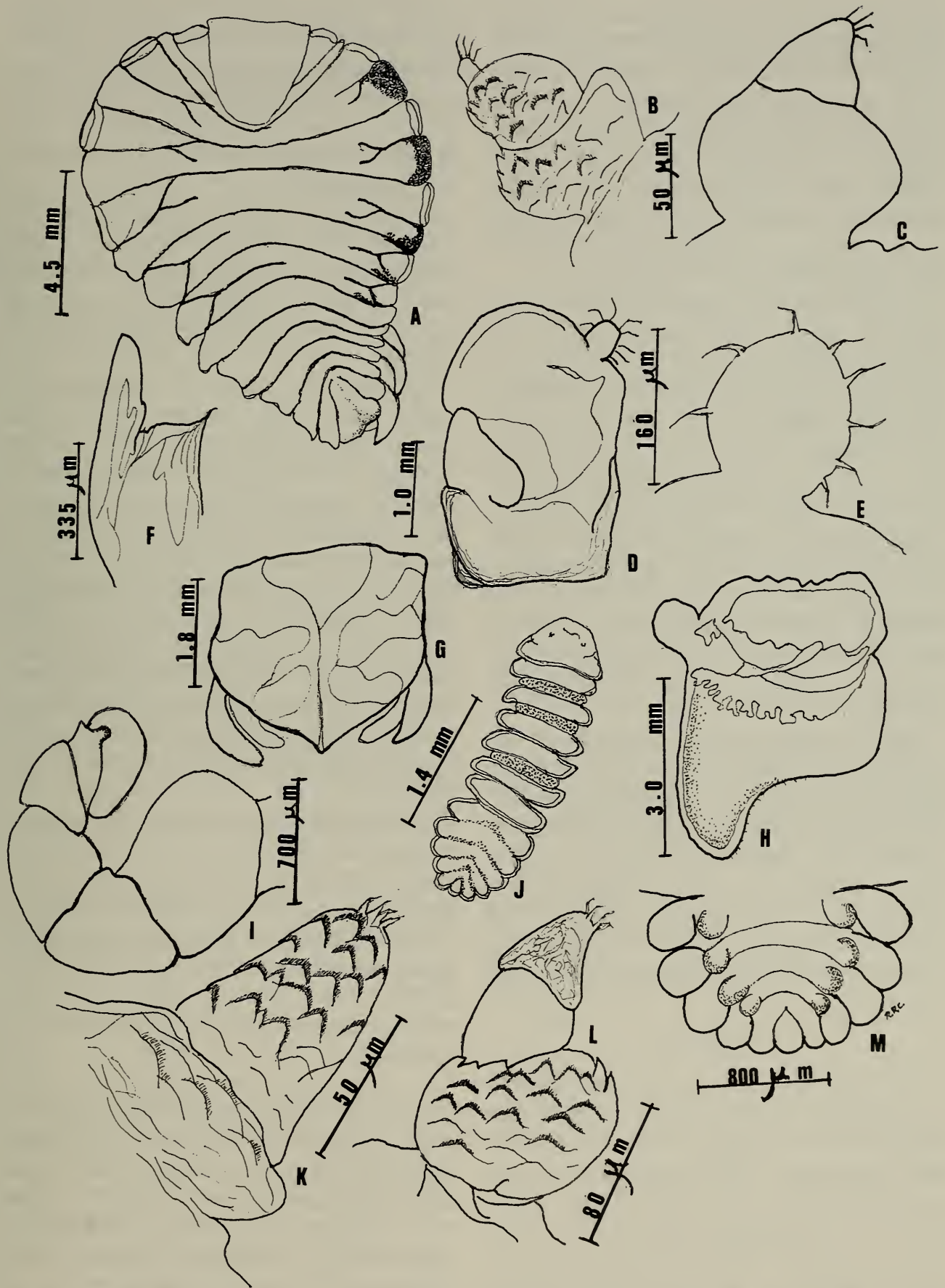


Fig. 2. *Probopyrus pacificensis*, new species. A-I, holotype female; J-L, allotype male; M, paratype. A, Dorsal view; B, Antenna 1; C, Antenna 2; D, Maxilliped; E, palp of same; F, plectron of same. G, Head; H, oostegite 1, internal view; I, Pereopod 7; J, Dorsal view; K, Antenna 2; L, Antenna 1; M, Pleon, ventral view.

tinct pleomeres deeply separated laterally, overall outline semicircular. The terminal pleomere button-shaped; 4 pairs of nearly sessile tuberculiform pleopods on pleomeres, often prominent and conspicuous in ventral view (Fig. 2M). No uropods.

Etymology.—Named after the Pacific Ocean to emphasize that it represents the first species of *Probopyrus* described from the Pacific coast of the Americas.

Variations.—The young females of *P. pacificensis* usually have ocular spots, the length-to-width ratio may vary, sometimes length and width are equal, and the pleopods don't stand out from the pleon edge. Adult females have from 8 to 10 setae in the maxilliped palpus; the digitate ovoid processes of the internal ridge of the first oostegite may be absent. The notch in the pleotelson may be present or absent in either young or adult females; whenever it is present it is shallow. Oostegites 3, 4 or both may be unpigmented, and the ridge of the barbula can be completely or partially bifurcated.

Head of males slightly rounded anterolateral corners; pereomeres can be strongly pigmented or lack of it. Sometimes the pereopods have a pigmented spot on the basis, the pleon of *P. pacificensis* is highly variable and can be as wide as long; the last pleomere sometimes is fused into the fifth pair and shows a triangular, button, or slightly bilobate shape, and the pleopods can vary from 4 to 5 pairs.

Discussion

The species of the genus *Probopyrus* "are so plastic and difficult to distinguish that their number is subject to considerable dispute" (Markham 1986), although many authors have tried to solve this problem. Richardson (1905) proposed in her identification key the female's size as the principal character to separate species; she distinguished *P. floridensis*, *P. bithynis* and *P. alpei* (Richardson, 1900) as large-sized species, and *P. latreuticola* as small-sized species.

Chopra (1923) considered the abdominal ratio of males and females as a basis for differentiating the species of *Probopyrus*, and recognized *P. palemoneticola*, *P. floridensis*, *P. bithynis*, and *P. panamensis* as valid species, but *P. pandalicola* was not mentioned by this author.

More recently Dale & Anderson (1982) recognized the validity of *P. bithynis*, *P. floridensis* and *P. pandalicola*; *P. panamensis* and *P. palaemoneticola*, which are recognized as valid species in this study, were not included.

Although the criteria for separating the species still remains controversial, I consider that they could be identified not only through the use of morphological features (e.g., size, presence of notch in the last pleomere of females, etc.), but also through the use of additional characters such as the pigmentation patterns of the individual (Bauer 1981, Knowlton 1986, Knowlton & Mills 1992), and specificity for the final host (Packard 1879; Bonnier 1900; Richardson 1904, 1905, 1912; Chopra 1923; Markham 1985a, 1985b), although some species seemingly can parasitize more than one host species.

Considering these facts, *P. pacificensis* can be separated from *P. palemoneticola* because in the latter the edges of the pereon are continuous, the carina of the seventh leg is quadrangular and high, and it parasitizes *Palaemonetes vulgaris* (Gissler, 1882; Richardson, 1904), while *P. pacificensis* has a rounded carina and it is a parasite of *M. tenellum*.

In *P. floridensis* the edges of the pereon are slightly separated and the seventh leg has a rounded mid-sized carina, and it parasitizes *Palaemonetes exilipes* and *P. paludosus* (Richardson, 1904; Dale & Anderson, 1982); *P. pacificensis* has the edge of pereomeres 5–7 separated, and the carina, although also rounded, is higher than in the former.

Probopyrus bithynis can be distinguished from all the American species of *Probopyrus*

because it has horn-shaped anterolateral processes on its head, a subtriangular and extremely high carina on the seventh leg (Richardson 1904, 1905), and it is a parasite of *M. ohione* and *M. olfersi*.

Probopyrus pacificensis was quoted as *P. pandalicola* by Guzman & Roman (1983), and Roman (1983, 1991) from the eastern Pacific, but morphological characteristics, pigmentation patterns, and its final host allow us to distinguish *P. pandalicola* in agreement with Markham's review (Markham 1985a: figs. 7–10). This species has 3 articles on each antenna while in *P. pacificensis* the second antenna has only 2; in addition, the shape of this structure is remarkably different between both species; in *P. pandalicola* the barbula has 2 obtuse points in middle position, in *P. pacificensis* this structure has a high and acute edge and the shape of the plectron is acute. The palp of the maxilliped of *P. pacificensis* is ovoid and high (Fig. 2D, E); in *P. pandalicola* it is subtrapezoidal in shape. The first oostegite of *P. pandalicola* is curved; in *P. pacificensis* the distal part is straight in relation to the anterior part (Fig. 2H). The first leg of *P. pandalicola* has no carina, but all the legs of *P. pacificensis* are carinated. The pleotelson of some specimens of *P. pandalicola* have no notch, but a small tip on the posterior edge; in *P. pacificensis* a slight notch is always present. Pigmentation is present on the first four dorsal thoracic segments of *P. pandalicola* on both sides; *P. pacificensis* has pigmentation only on segments 2–4 on the smaller side (Figs. 1A, 2A).

P. pacificensis morphologically is more similar to *P. panamensis* than to the other species of the genus, but it is differentiated because the edge of the pereon is continuous while in *P. pacificensis* the borders of the pereomeres 5–7 are separate. In *P. panamensis* the carina of the seventh leg is high and middle-sized, in *P. pacificensis* it is high, rounded, and bigger than in the former; *P. panamensis* parasitizes *M. acanthurus*. Fe-

males of *P. pacificensis* are slightly bigger than *P. panamensis*; both species have the anterior margin of head rounded, and the anterolateral angles small and acute. In *P. panamensis*, the head is wider than long, and the eyes are always absent (Richardson 1905); in *P. pacificensis* the head is slightly longer than wide, and eyes or ocular spots sometimes are present.

In general females of *P. pacificensis* show a more uniform dorsal pigmentation pattern than males on the dorsal side; the pleon of the males is almost always whitish or yellowish, and they have four or five pairs of conspicuous pleopods, while males of *P. panamensis* have three pairs of pleopods only (Richardson 1912).

Males of *P. panamensis* have the head widely rounded while in *P. pacificensis* it is slightly trapezoidal. The pleon of *P. pacificensis* is clearly wider than its pereon; in *P. panamensis* it is rather narrow, although in both species the shape of the pleon is highly variable.

Probopyrus pacificensis differs from all the described species from the Atlantic coast of North America, being larger, except for *P. panamensis*, because of the presence of pigmented patches on tergal projections of pereomeres 2–4, well developed pleopods protruding from the edge, and a high, round-shaped carina on all the legs. The males have a larger length/width ratio, trapezoidal shape of the head, and a bigger number of pleopods than *P. panamensis*.

Finally, for the reasons stated above, and because of the distribution of the species compared to *P. pacificensis*, I agree with Dale and Anderson (1982), in recognizing *P. pandalicola*, *P. floridensis*, and *P. bithynis*; however, *P. panamensis* and *P. palaemoneticola* should also be included as valid species.

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